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A new species of spider (Araneae, Linyphiidae, *Islandiana*) from a southern Indiana cave

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Abstract

The genus *Islandiana* (Araneae, Linyphiidae) was erected by Braendegaard in 1932 and is comprised of 14 species, most of which are native to North America. Herein we add a 15th species, *Islandiana lewisi* **sp. n.**, from southern Indiana, USA. This species resembles both *I. flavoides* Ivie, 1965 and *I. cavealis* Ivie, 1965, the latter of which is geographically-close.

Keywords

Erigoninae, Midwest, subterranean, underground, karst, sheet-web spider

Introduction

The linyphiid genus, *Islandiana* Braendegaard, 1932 possesses 14 species (World Spider Catalog 2017), most of which are in the United States. However, two species in the genus, *I. falsifica* Keyserling, 1886 and *I. cristata* Eskov, 1987, have Holarctic distributions and another, *I. princeps* Braendegaard, 1932, can be found in North America as well as Greenland and Iceland. The remaining species, 11 out of the 14, are restricted to the US and Canada (World Spider Catalog 2017). Most of the species in *Islandiana* may be found under rocks near the ground in forests, fields, mountains, beaches, and a

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variety of other habitats in their known range (Ivie 1965). Four species are known only from caves in the US (Ivie 1965). The genus consisted of only two species, *I. falsifica* and *I. princeps*, upon its creation by Braendegaard (1932), but had two species added to it by Kaston (1948; *I. flaveola* Banks, 1892 and *I. longisetosa* Emerton, 1882). A revision of the genus was conducted by Ivie (1965) that added nine new species. A single species from Russia, Alaska, and Canada was later added by Eskov (1987).

A re-examination of new distribution records listed for the state of Indiana by Milne et al. (2016) revealed a misidentification of "*I. cavealis*." These specimens – collected from Stygian River Cave in southern Indiana were found not to be *I. cavealis*, but an undescribed species within the same genus. Herein we describe this species.

Methods

All measurements are in millimeters. Measurements were taken electronically using a Leica M165C stereoscope, Leica DMC2900 attached digital camera, and associated Leica Application Suite software (LAS Ver. 4.9.0 [Build: 129], Leica Microsystems, Switzerland) at the University of Indianapolis. Photographs were taken with specimens placed in glass dishes containing white sand and ethanol. Carapace width was measured at the widest part of the carapace. Specimens were prepared for SEM photography by dehydration using ethanol solutions that graduated from 70% to 100% over 5-minute intervals. Specimens were then placed in Hexamethyldisilazane (HMDS; 99+%; Alfa Aesar, Heysham, England) for 5 minutes before being removed and placed on filter paper to dry for 5 minutes. Specimens were then mounted on SEM stubs using 12 mm Pelco Tabs (TED PELLA, Inc. - carbon conductive tabs), sputter coated in gold (Cressington Scientific Instruments, Model No. 108) and photographed using a JEOL JCM-6000 NeoScope benchtop scanning electron microscope. The holotype male and paratypes of females and males were deposited at The Field Museum of Natural History (FMNH) in Chicago, IL. *Islandiana cavealis*, *I. flavoides*, and *I. speophila* were examined on loan from The American Museum of Natural History.

Taxonomy

***Islandiana lewisi* sp. n.**
http://zoobank.org/0BF2BC6C-9956-43E9-A863-76D196B211F8
Figs 1–4

Islandiana cavealis (Ivie, 1965): Milne et al. 2016: 80 (male, female, misidentification).

Type-specimen. Holotype male and paratype males and females (FMNH, Cat. No. #3260642), in 90% alcohol, with genitalia in separate microvial. Label: "O'Bannon Woods State Park, Stygian River Cave, N38°10', W086°18', (parking lot). *Islandiana lewisi*."

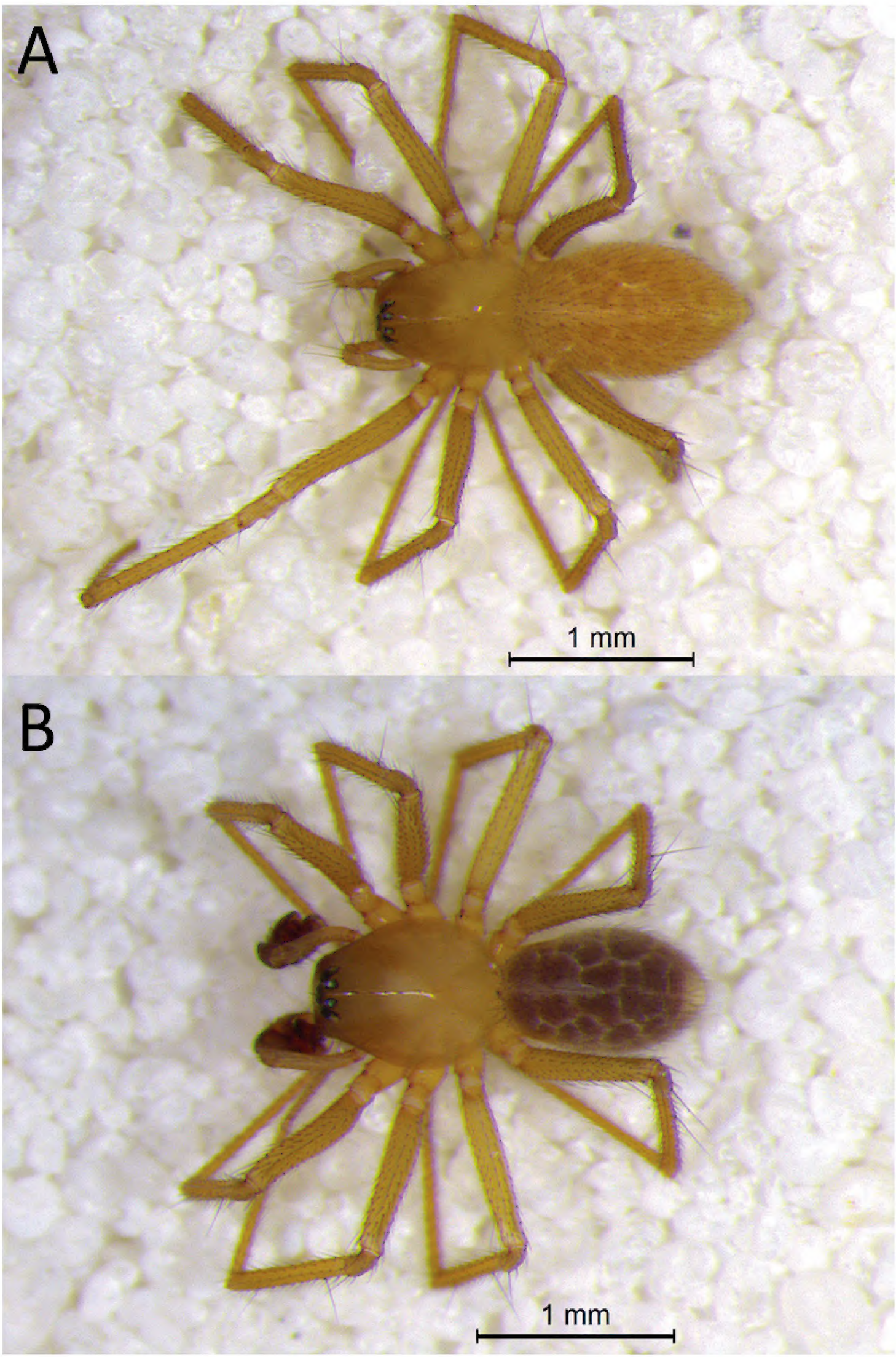

Figure 1. Habitus of *Islandiana lewisi* sp. n. **A** female **B** male.

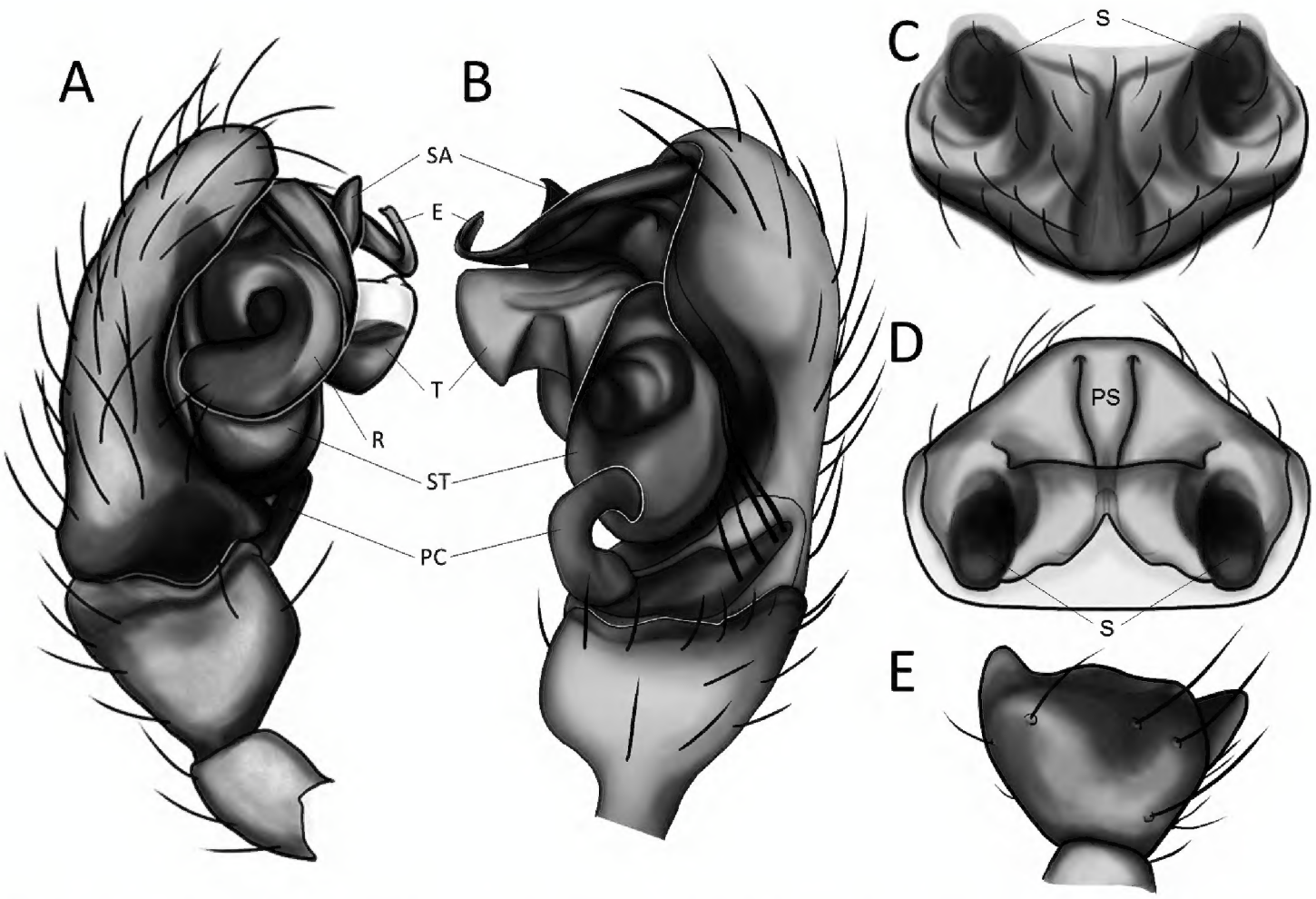

Figure 2. Illustrations of *Islandiana lewisi* sp. n. structures. **A** Left palp of male, medial view **B** Left palp of male, lateral view **C** Epigynum, ventral view **D** Epigynum, flipped – dorsal view **E** Tibial apophysis of left palp of male. E = Embolus; R = radix; SA = suprategular apophysis; ST = subtegulum; T = tegulum; PC = paracymbium; S = spermathecae; PS = posterior sclerite.

Specimen collected by M. Milne on 23 October 2016. Type-locality: USA, Indiana: Harrison County, Harrison-Crawford State Forest, Stygian River Cave (N38°10', W86°18'; exact coordinates hidden due to the ecological sensitivity of the type locality).

Examined comparative material. ***Islandiana cavealis:*** **USA:** Kentucky: Fayette County, Picadome Cave (N37°, W84°) 1 female (AMNH_IZC 00328222); collected by C. Krekeler and J. Rittmann on 1 July 1957. ***Islandiana speophila*****: USA:** West Virginia: Pendleton County, Trout Cave (N38°, W79°) 1 female (AMNH_IZC 00328223); collected by L.G. Conrad on 4 March 1961. ***Islandiana flavoides*****: USA:** New York: Orient (N41°, W72°) 1 male (AMNH_IZC 00328224); collected by C.R. Crosby and S.C. Bishop on 21 June 1934.

Etymology. The species name is a patronym in honor of our friend and colleague Dr Julian J. Lewis, a cave and karst specialist, a leading expert in North American isopod taxonomy, and the original collector of the species.

Diagnosis. This species is most similar to *I. flavoides* Ivie, 1965, a species native to New York, USA and keys out to this species using the key provided by Ivie (1965). However, the males of *I. lewisi* sp. n. possesses a sinuous embolus not present in *I. flavoides* (Figs 2A, 3 vs. fig. 27 in Ivie 1965). Moreover, the two enlarged setae on the paracymbium are thinner in *I. lewisi* sp. n. (Fig. 2B, 3C vs. fig. 27 in Ivie 1965) than in

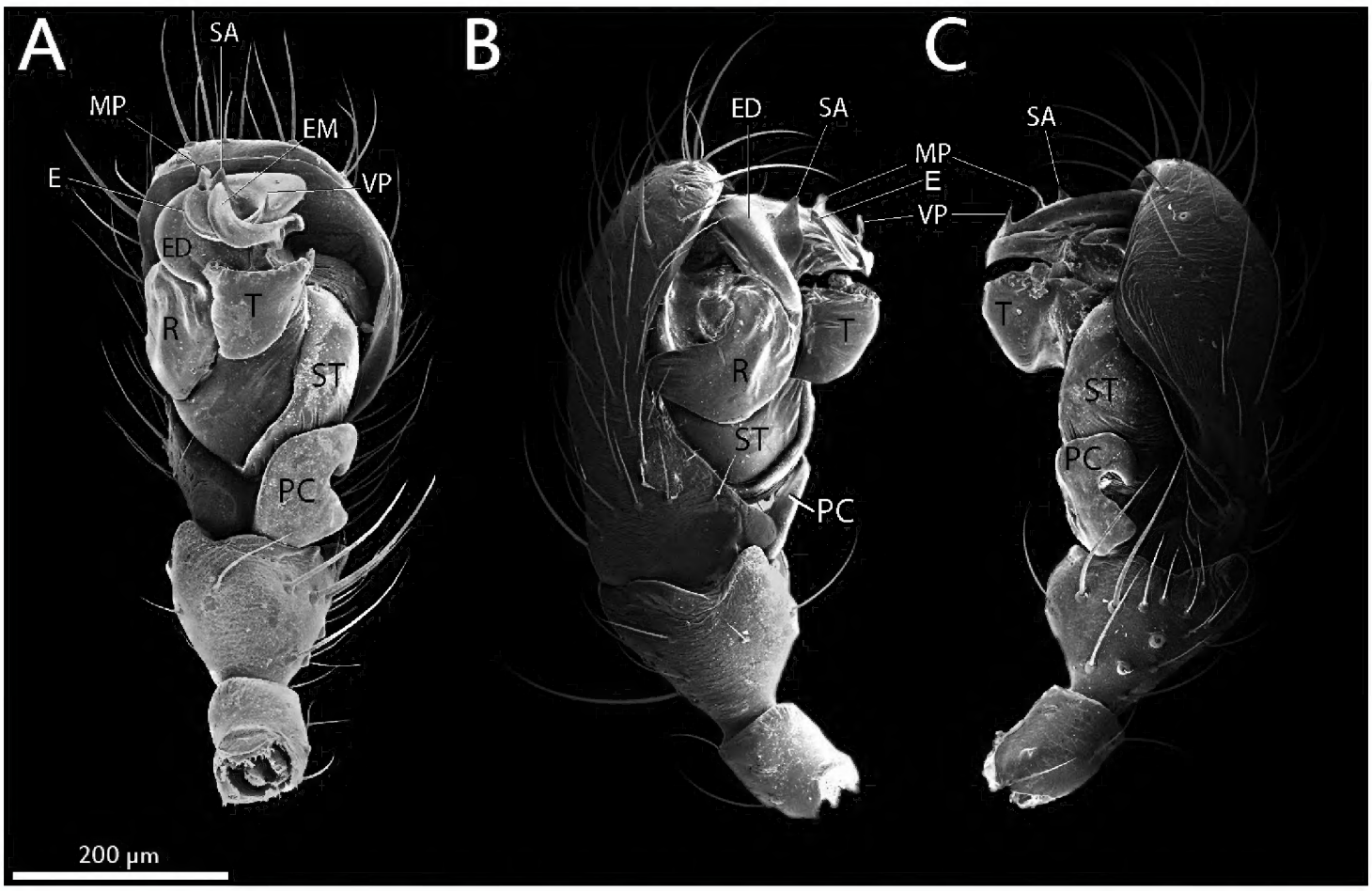

Figure 3. SEM micrographs of the left palp of *Islandiana lewisi* sp. n. **A** Ventral **B** Medial **C** Lateral. E = Embolus; ED = Embolic division; EM = Embolic membrane; MP = medial projection of ED; VP = ventral projection of ED; R = radix of ED; SA = suprategular apophysis; ST = subtegulum; T = tegulum; PC = paracymbium.

I. flavoides, and the pointed tibial apophysis is rounded in this new species (Fig. 2E vs. fig. 28 in Ivie 1965) compared to *I. flavoides*. The males and females of *I. lewisi* sp. n. are also larger (mean of 2 mm for the male and 2.2 mm for the female vs. 1.5 mm male and 1.8 mm female in *I. flavoides*). The female also differs from *I. flavoides* females in that the epigynum of the new species has a slightly longer scape, lacks the large circular posterior plate, and possesses ovoid spermathecae compared to the circular spermathecae in *I. flavoides* (Figs 2C–D, and 4). The female epigynum also resembles that of *I. cavealis*, but the *I. lewisi* sp. n. epigynum is more flattened posteriorly and the spermethecae are set more anteriorly than in *I. cavealis* (Figs 2C–D, and 4 vs. figs 50–51 in Ivie 1965).

Description. Male. (N = 2) Carapace 0.88–0.94 long, 0.69–0.75 wide. Total length 1.90–2.00. Carapace concolorous dusky yellow to tan with a small amount of black surrounding each eye. Five short setae along median line of carapace from fovea leading up to eyes, other setae between posterior median eyes and other eyes leading back to fovea. Abdomen light gray (Fig. 1B). Posterior median eyes about half the size of other eyes. Chelicerae dusky yellow with seven teeth on promargin and five denticles on retromargin. Chelicerae with mastidion low-set near teeth. Stridulatory file present with 14 stridulae. Maxillae concolorous and yellow with labium also dusky yellow. Sternum dusky yellow. Spination is as follows (only surfaces bearing spines listed): femora: I, II, III, IV v0-0-2; patellae: I, II, III, IV d0-0-1; tibiae: I, II, III d1-0-1; IV d1-0-0.

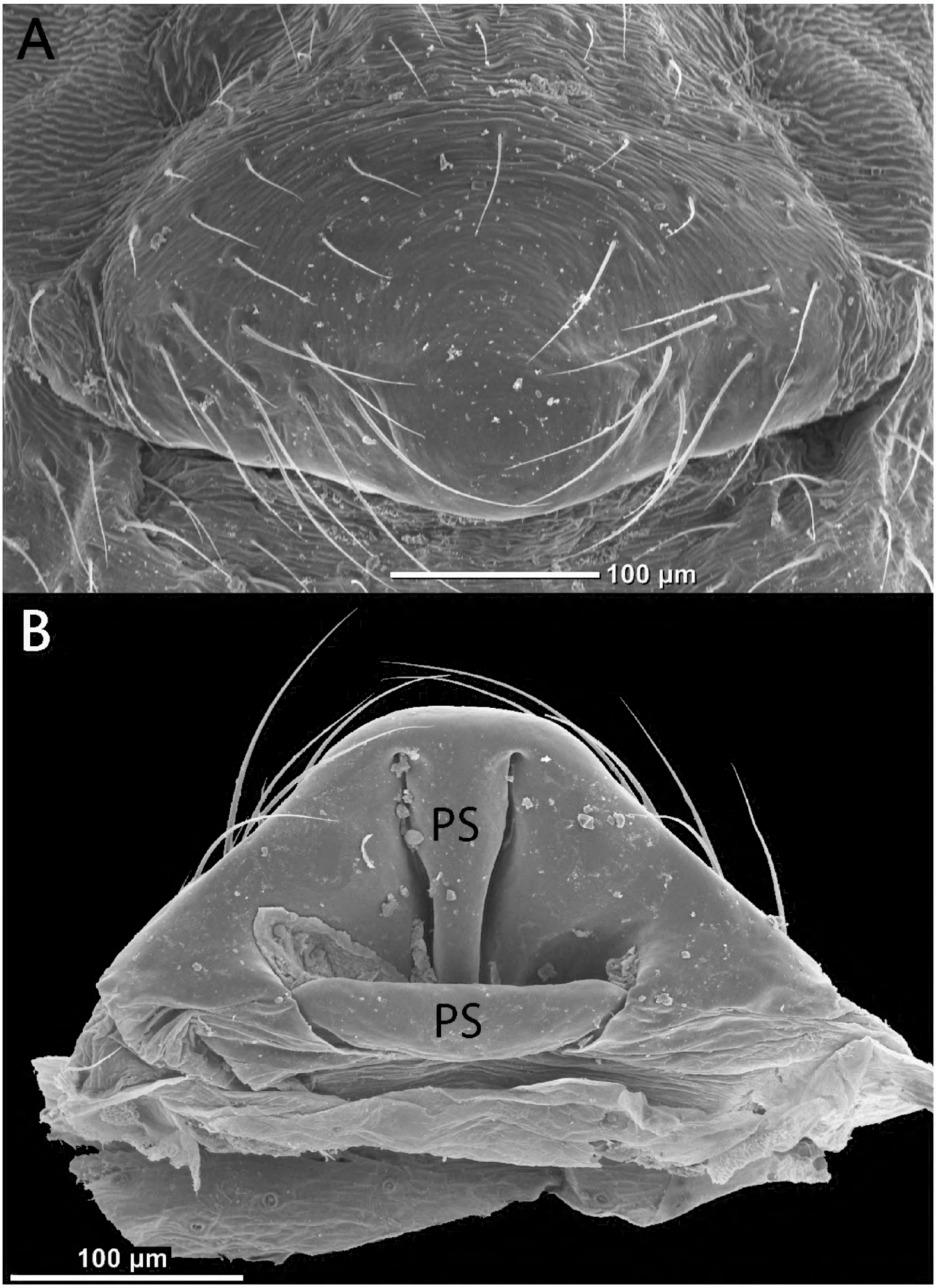

Figure 4. SEM micrographs of the epigynum of *Islandiana lewisi* sp. n. **A** Epigynum, ventral view **B** Epigynum, flipped – dorsal view. PS = posterior sclerite.

Mature male palp with tibial apophysis rather short and stout (Fig. 2E). Paracymbium notched, curved in a thick "C"-shape, and with two long thin setae and two short thin setae emanating from a deep section of the structure (Figs 2B, 3C). Large tegulum above subtegulum that extends out past subtegulum. Embolus within embolic membrane curves around in full 360° loop near anterior end of cymbium. Suprategular apophysis projects anteriorly within the center of the embolic loop. Ventral and medial processes project anteriorly from embolic division (Fig. 3).

Female. (N = 4) Carapace 0.88–1.00 long, 0.69–0.79 wide. Total length 2.1–2.3. Carapace coloration and setae pattern same as male. Abdomen light yellowish to tan (Fig. 1A). Chelicerae dusky yellow with six teeth on promargin and five denticles on retromargin. Chelicerae lacking mastidion. Stridulatory file present with 16 –18 stridulae. Maxillae, labium, and sternum coloration same as in male. Spination same as in male.

Epigynum similar to *I. cavealis*. Epigynum protruding ventrally at distal portion; conical shape, posterior sclerite wider distally with flattened triangular shape proximally (Figs 2C–D, 4). Triangular shape of sclerite difficult to see using light microscopy.

Distribution. Known only from the type locality.

Habitat. Stygian River Cave is short and consists of a room filled with large, wet, muddy rocks and boulders. Because of the short length of the cave, the biota is likely heavily influenced by low winter humidity. The cave sits at the confluence of the Blue and Ohio rivers and at least part of the cave is regularly underwater when these rivers rise. These specimens were largely found in webs in between the large boulders within the largest room of the cave. The type locality was only visited once and were therefore only collected once, on October 23rd, 2016.

Acknowledgements

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